

## SUMMARY

Diphenyl isothiohydantoin has been condensed with benzaldehyde, o-nitro-benzaldehyde, cinnamic aldehyde, furfural, salicylic aldehyde, 3,5 dichloro salicylic aldehyde, protocatechuic aldehyde, vanillin, chloro-vanillin, nitro-vanillin and bromo-vanillin, and the condensation products analyzed and described.

GEOLOGY.—*Note on the occurrence of the Choptank formation in the Nomini Cliffs, Va.*<sup>1</sup> WENDELL C. MANSFIELD, U. S. Geological Survey. (Communicated by L. W. STEPHENSON.)

The Choptank formation, the middle formation of the Chesapeake group of the Maryland Miocene, was recognized in the Nomini Cliffs, Westmoreland County, Va., by Shattuck<sup>2</sup> in 1904. He says: "In the Nomini Cliffs, Virginia, it [the Choptank formation] is present as a 50-foot bed between the Calvert formation below and the St. Mary's formation above."

In 1906 Clark and Miller,<sup>3</sup> discussing the occurrence of the Choptank in Virginia, stated: "This formation is prominently exposed in southern Maryland and Virginia, outcropping in a nearly complete section in the Nomini Bluffs on the Potomac River."

In the same year Shattuck and Miller<sup>4</sup> reiterated the earlier statement of Shattuck as to the occurrence of the Choptank in the Nomini Cliffs.

In 1912, however, Clark and Miller<sup>5</sup> referred the entire Miocene portion of the section at Nomini Cliffs to the Calvert formation, recognizing neither the Choptank nor the St. Mary's formation in that exposure. They wrote:

"The deposits hitherto described as Choptank in the Nomini Bluffs are now known, from a more exhaustive study of both the stratigraphy and paleontology, to belong to the Calvert formation. It is possible that the Choptank may be represented, as it gradually thins out, in the low country lying between the known outcrops of the Calvert and St. Mary's formations but buried beneath the cover of Pleistocene formations."

The purpose of this note is to confirm the presence of the Choptank formation in the section at Nomini Cliffs, as originally interpreted

<sup>1</sup> Published by permission of the Director of the U. S. Geological Survey.

<sup>2</sup> SHATTUCK, G. B., Md. Geol. Survey, Miocene Text, pp. LXXIX-LXXX, 1904.

<sup>3</sup> CLARK, WM. B., and MILLER, B. L., Va. Geol. Survey Bull. 2: 18, 1906.

<sup>4</sup> SHATTUCK, G. B., and MILLER, B. L., U. S. Geol. Survey Geol. Atlas, St. Marys folio (No. 136), Md.-Va., p. 3, col. 2, 1906.

<sup>5</sup> CLARK, WM. B., and MILLER, B. L., Va. Geol. Survey Bull. 4: 140-141, 1912.

by Shattuck, and also to indicate the occurrence of the basal portion of the overlying St. Marys formation.

The Choptank formation in Maryland, according to Maryland Geological Survey Text, 1904,<sup>6</sup> is subdivided into five zones, which are numbered 16 to 20, inclusive. Zones 17 and 19 are very fossiliferous, corresponding respectively to "zone e" and "zone f" of Harris,<sup>7</sup> while zones 16, 18 and 20 are either without fossils or sparingly fossiliferous.

A comparison of the stratigraphic sequence, lithologic character, and faunal contents of the beds exposed in the Calvert Cliffs, Maryland, with those in the Nomini Cliffs and elsewhere in Virginia, seems to show conclusively that the Choptank formation is represented in the Nomini Cliffs. One section in the Calvert Cliffs very closely duplicates the section in one part of the Nomini Cliffs. The Maryland and Virginia sections are given below.

*Section about 1½ miles below Flag Pond, Calvert Cliffs, Calvert County, Maryland*

By W. C. MANSFIELD and W. P. POPENOE

	Approximate thickness Feet
Pleistocene:	
Sand and gravel.....	30-40
Miocene:	
St. Marys formation:	
Drab plastic clay (zone 22).....	15
Clean fine-grained sand, 3 feet, underlain by dark gray slightly sandy semi-plastic clay, with a few fossil impressions (zone 21).....	18
Choptank formation:	
Bluish sandy clay, with a 1-foot layer of indurated fossiliferous sand at top containing the following species: <i>Pedalion maxillata</i> (Deshayes), <i>Pecten madisonius</i> Say, <i>Asaphis centenaria</i> (Conrad), <i>Metis biplicata</i> Conrad, <i>Discinisca lugubris</i> (Conrad), <i>Schizoporella doverensis</i> Ulrich and Bassler <sup>8</sup> (zone 20).....	20
Light brown very fossiliferous sand with an indurated sandstone layer, about 2 feet thick, at the top, carrying many individuals of <i>Pecten madisonius</i> Say (zone 19).....	10-12
Bluish poorly fossiliferous sandy clay (zone 18).....	8-10
Dark gray very fossiliferous sand (zone 17), exposed.....	1

The subdivisions in the preceding section are separated into zones believed to correspond approximately to those designated in the Maryland Geological Survey Miocene Text, 1904.

<sup>6</sup> *Op. cit.*, pp. LXXXI-LXXXII.

<sup>7</sup> HARRIS, G. D., *Amer. Journ. Sci.* 45: ser. III, pp. 21-31, 1893.

<sup>8</sup> Identified by Dr. RAY S. BASSLER, of the U. S. National Museum.

Section of Nomini Cliffs, right bank of Potomac River, Va., about 1½ miles from lower end of Cliffs

By W. C. MANSFIELD

	Approximate thickness Feet
Pleistocene:	
Reddish clay, sand and gravel.....	40
Miocene:	
St. Marys formation:	
Very plastic unfossiliferous sandy clay. Upper 3 feet consists of laminated clay alternating with thin fine sand partings. (Corresponds to zone 21.).....	18
Probably Choptank formation:	
Material similar to the above but contains 2 or 3 ferruginous layers. Appears to be unfossiliferous. (Corresponds approximately to zone 20.).....	30
Choptank formation:	
Dark brown rather soft fossiliferous sand, with an indurated sandstone layer about 2 feet thick at the top containing many individuals of <i>Pecten madisonius</i> Say. The following species were obtained from the sands: <i>Arca staminea</i> Say, <i>Pecten madisonius</i> Say, <i>Pecten marylandicus</i> Wagner, <i>Astarte obruta</i> Conrad, <i>Dosinia</i> sp. (Corresponds to zone 19.).....	10
Probably Choptank formation:	
Fossiliferous greenish-gray clayey sand. One large specimen of <i>Isocardia fraterna</i> Say was found 20 feet below indurated sandstone ledge. (Believed to correspond to zone 18 and perhaps to zone 17.).....	30

In the above section no fossils were found above the indurated layer that overlies zone 19. In places, where the material has not slumped, the cliffs stand nearly vertical and are impossible to scale, and the exact thickness of the Choptank formation can not readily be determined, but it probably amounts to 50 feet or more. The recognition of the Choptank formation in the section is based chiefly on the fossils contained in the dark brown sand 30 to 40 feet above the base. The following species, as listed above, indicate the correspondence of this layer with zone 19 of the Maryland Choptank: *Arca staminea* Say<sup>9</sup> is reported only from the Choptank formation; *Pecten Marylandicus* Wagner<sup>10</sup> is reported at six localities in the Choptank formation and at only one in the Calvert formation; *Astarte obruta* Conrad<sup>11</sup> is reported only from zone 19 of the Choptank formation at Governor Run.

<sup>9</sup> Md. Geol. Survey, Miocene Text, p. 388, 1904.

<sup>10</sup> *Op. cit.*, p. 377.

<sup>11</sup> *Op. cit.*, p. 354.